

CA1  
FS 200  
-86 P67

Government  
Publications

④

0

1

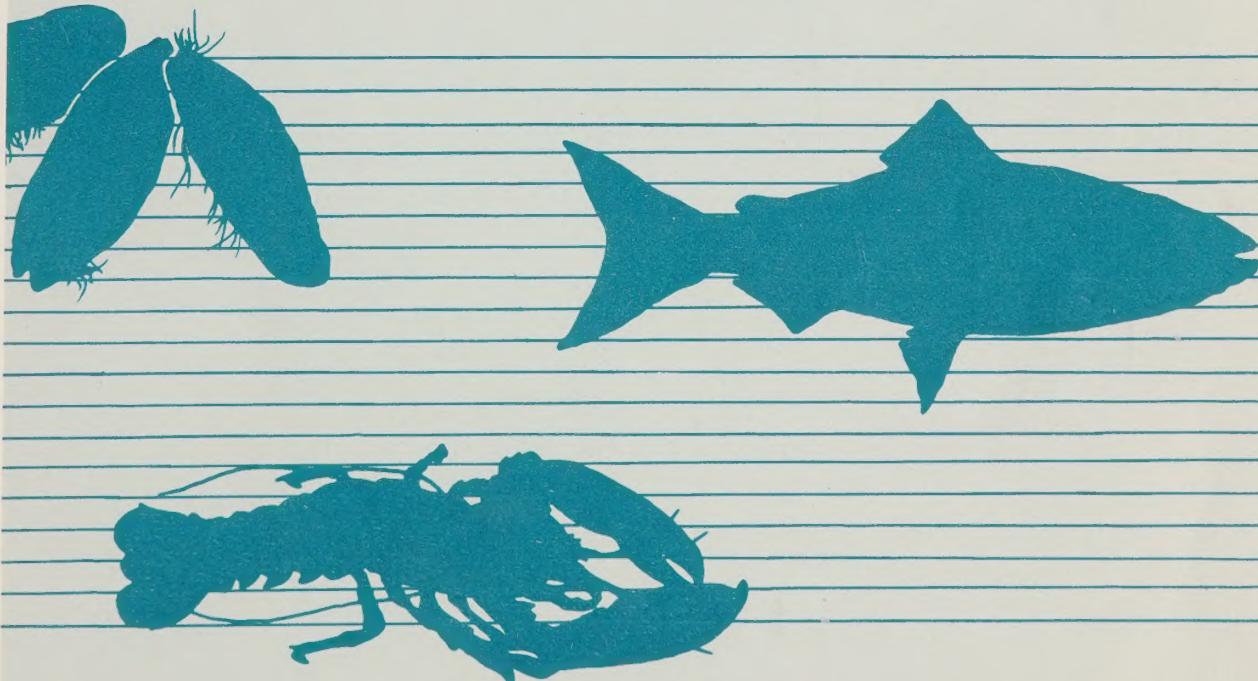
es and Oceans

Pêches et Océans

Government  
Publications

# PRIVATE- SECTOR AQUACULTURE PRODUCTION AND VALUE IN CANADA:

## Overview

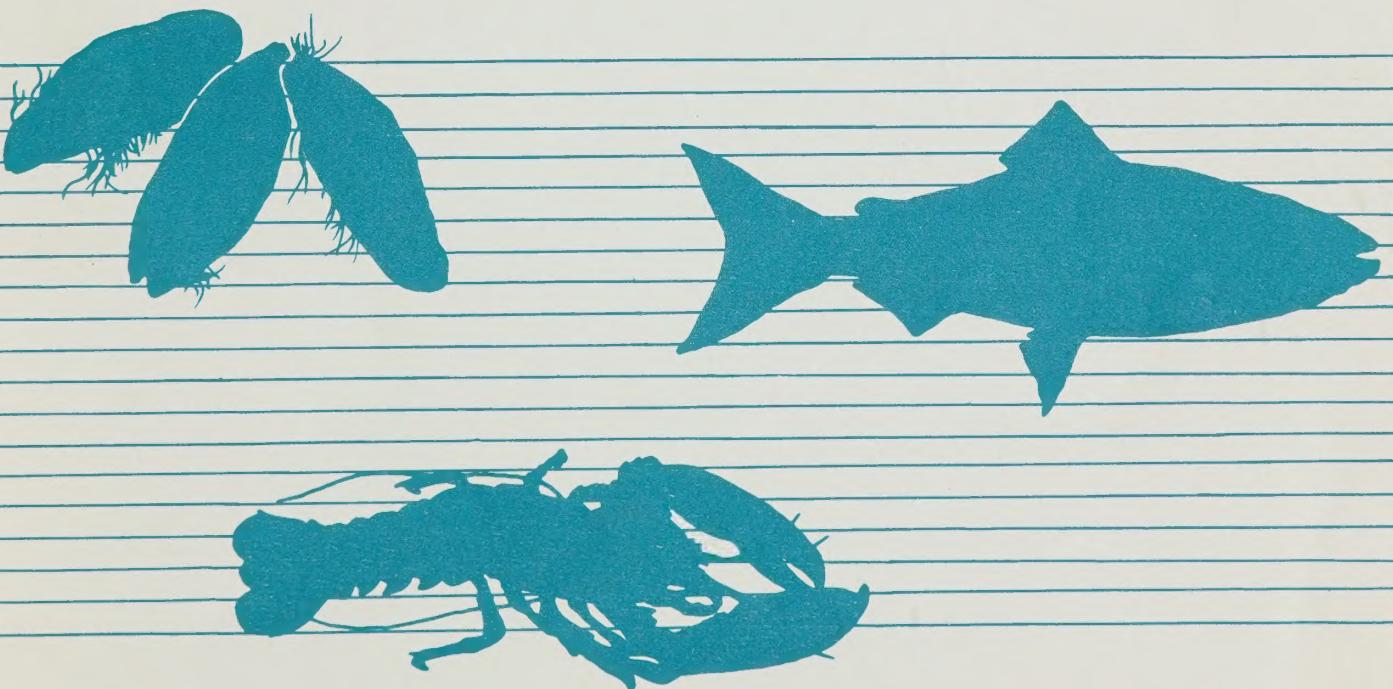


Canada



# PRIVATE- SECTOR AQUACULTURE PRODUCTION AND VALUE IN CANADA:

## An Overview



# PREFACE

This report, was prepared by Ron Macdonald for the Department of Fisheries and Oceans in August 1985. The data and views presented herein are the responsibility of the author rather than of the Department.

As noted by the author, the statistics were gathered from several sources. While there might be disagreement with some of the data presented for individual species and provinces, the Department is releasing the report because it provides a comprehensive overview of the industry as it existed in 1983. The Department believes that this report will contribute to the public understanding of, and discussion about, the prospects for the development of a Canadian aquaculture industry.



# FOREWORD

This report, presented primarily in a graphical format, was prepared in response to a need for a brief internal overview of the aquaculture industry, particularly its production volume and value. The report focuses on the private-sector production of food fish and includes some pay angling figures. Data on government and private-sector raising of fish for stocking purposes have not been included.

When working with statistics, especially those which have been gathered from a variety of sources, care must be taken to avoid misrepresentation. The absence of a standardized data collection and assessment system highlights the fact that action should be taken to remedy this situation. The unavailability of trend statistics camouflages the fact that there has been variability in Canadian aquaculture production over the last decade, both in terms of the species produced and the volume of output from the various regions in Canada. This report, therefore, presents a general picture of the Canadian commercial aquaculture industry in 1983.

Ron Macdonald

# TABLE OF CONTENTS

	Page
INTRODUCTION .....	5
BACKGROUND .....	5
THE INTERNATIONAL SITUATION .....	6
THE CANADIAN INDUSTRY .....	7
ANNEX A — AQUACULTURE STATISTICS .....	8
BIBLIOGRAPHY .....	11

# LIST OF FIGURES

	Page
<b>Figure 1:</b> International Aquaculture .....	6
Production Trends, 1975-1984	
<b>Figure 2:</b> International Aquaculture .....	6
Production (1984)	
<b>Figure 3:</b> A Comparison Between Canadian .....	7
Aquaculture and the Total Canadian Fisheries Production (1983)	
<b>Figure 4:</b> A Comparison Between Aquaculture .....	7
and the Total Canadian Fisheries Production on the Basis of Equivalent Species (1983)	
<b>Figure 5:</b> Aquaculture Production and .....	8
Value (1983)	
<b>Figure 6:</b> Aquaculture Production and Value .....	8
by Species (1983)	
<b>Figure 7:</b> Distribution of Aquaculture .....	8
Production (Metric Tonnes) (1983)	
<b>Figure 8:</b> Distribution of the Value from .....	9
Aquaculture (1983)	



# INTRODUCTION

Aquaculture, or the husbandry of aquatic organisms, has emerged as an industry which offers Canadians significant economic and social opportunities.

At present, people obtain the majority of their food from the sea by hunting and gathering. World fisheries landings for 1984 are estimated at slightly more than 80 million tonnes, whereas worldwide aquaculture production is estimated at about 10 million tonnes.

The history of aquaculture is long. Records indicate that fish farming in freshwater ponds took place both in ancient Egypt and in China around 500 B.C. Even though the farming of fin-

fish and shellfish has been pursued successfully for more than 2,000 years, its potential is far from being fully developed.

Leading countries for aquaculture production in 1984 were China (2.5 million tonnes), Japan (more than 1.0 million tonnes), Russia (330,000 tonnes), and the U.S.A. (200,000 tonnes). Canadian aquaculture production for 1984 is estimated to have been 6,000 tonnes.

The national production level of the Canadian aquaculture industry has been fairly constant over the last decade, but it is widely expected that the industry is on the threshold of sustained economic growth and commercial development.

# BACKGROUND

Commercial fish culture has emerged in Canada in response to various forces. Some of these are rising prices for food fish, profit, increased demand for protein from fish, and recent advances in the science and technology of aquaculture.

Salmonid hatcheries were in place in Canada in the late 1800s. These initial efforts were small-scale government operations. Even though the history of public-sector aquaculture throughout Canada is relatively long, private-sector aquaculture, particularly in saltwater, is just beginning as an industry.

Numerous species of finfish and shellfish are currently being produced in Canada through commercial aquaculture processes. Data are available on nine of these species which have significant levels of commercial production. The main focus of this report, therefore, is on these species, which include Atlantic salmon, Pacific salmon (coho, chinook), trout (rainbow, brook), tuna, mussels, and oysters (American, Pacific).

Atlantic salmon (*Salmo salar*) is the most valuable species under culture in the Atlantic region. The prime area for the commercial culture of Atlantic salmon is in the Bay of Fundy, New Brunswick, even though some production also occurs in Nova Scotia and Newfoundland. Pilot-scale hatcheries for Atlantic salmon have also been initiated in British Columbia. Atlantic salmon shows substantial potential, and the possibility exists that the species could become a significant product for domestic and export markets.

Pacific salmon aquaculture production is accounted for by two species: coho (*Oncorhynchus kisutch*), which accounts for 84 per cent of 1983 production; and chinook (*Oncorhynchus tshawytscha*), 16 per cent.

Private-sector aquaculture of Pacific salmon started in the early 1970s, and is rapidly moving from the cottage-industry scale to larger-scale production facilities. Like the Atlantic salmon, Pacific salmon have potential for significant future market growth if the challenge of stiff competition from Norwegian Atlantic salmon production can be met.

Trout is the most valuable species currently produced commercially in Canada. Of the two species currently cultivated, rainbow trout (*Salmo gairdneri*) and brook trout (*Salvelinus fontinalis*), rainbow is the most prevalent primarily due to regu-

lations in many provinces prohibiting the rearing of other types of trout. The aquaculture of rainbow trout occurs in all regions of Canada and has one of the longest histories of any species produced. Rainbow trout is easily domesticated and, because culture technology is well developed, the inherent risks are relatively low. Possible limits to future growth may be high production costs and stiff competition from the United States.

Bluefin tuna (*Thunnus thynnus*) is currently produced only in the Maritimes. Aquaculture production of tuna peaked in the late 1970s and then declined when quotas were imposed on the enclosure capture of tuna for rearing.

Blue mussels (*Mytilus edulis*) are cultivated in Atlantic Canada where the industry is now reaching much higher production levels. Pilot-scale operations also exist in British Columbia and Québec. Canadian producers are attracted to this species because the technology involved in cultivating it is relatively simple and production costs are relatively low. Domestic markets have been expanding and it is felt that the U.S.A. and western Europe offer target markets. Current estimations indicate that mussels may soon surpass the oyster in value of production.

American oysters (*Crassostrea virginica*) and European oysters (*Ostrea edulis*) are currently raised in the Atlantic region, while Pacific oysters (*Crassostrea gigas*) are produced in British Columbia. Oyster was the first species cultured in British Columbia. The growth potential of oysters on both coasts is promising, with the U.S.A. offering a possible export market. Although production declined slightly in the mid 1960s, the value has increased. The technology of oyster culturing is proven and with improved production stability, product quality, and financial and governmental support, market potential might well be achieved.

Research and pilot-scale production are currently under way for various other species which show signs of future commercial viability such as; American lobster (*Homarus americanus*), scallops (*Placopecten magellanicus*, *Patinopecten yessoensis*, *Argopecten irradians*), Clams (*Mya arenaria*), abalone (*Haliotis kamtschatkana*), herring (*Clupea pallasii*), sablefish (*Anoplopoma fimbria*), and Irish moss (*Chondrus crispus*).

# THE INTERNATIONAL SITUATION

Worldwide aquaculture production has increased dramatically since 1970 when it registered approximately 2.6 million tonnes. Current estimates place the output at approximately 10 million tonnes, or about 10 per cent to 12 per cent of total fisheries output worldwide. With the necessary financial, scientific and organizational support, aquaculture is expected to continue to show dramatic annual increases. Carp and tilapia are the major species produced internationally, followed by various seaweeds and molluscs such as oysters, mussels and clams.

As noted in Figure 1, some countries have experienced tremendous rates of growth in aquaculture production over the last decade, the most notable example being Norway where output increased by some 1000 per cent from 1975 to 1984.

The countries with which Canada is compared in Figures 1 and 2 were chosen on the basis of the frequency of their comparison to Canada in current literature, the similarity of their aquaculture technologies (cold-water production), and their status as direct competitors to Canada in the production of various species. Omitted are some major producers such as China (2.5 million tonnes in 1984) and the U.S.S.R. (330,000 tonnes in 1984).

It is interesting to note in Figure 2 that Japan's aquaculture production of 1.0 million tonnes in 1984 was almost equivalent to Canada's commercial catch of 1.1 million tonnes that year.

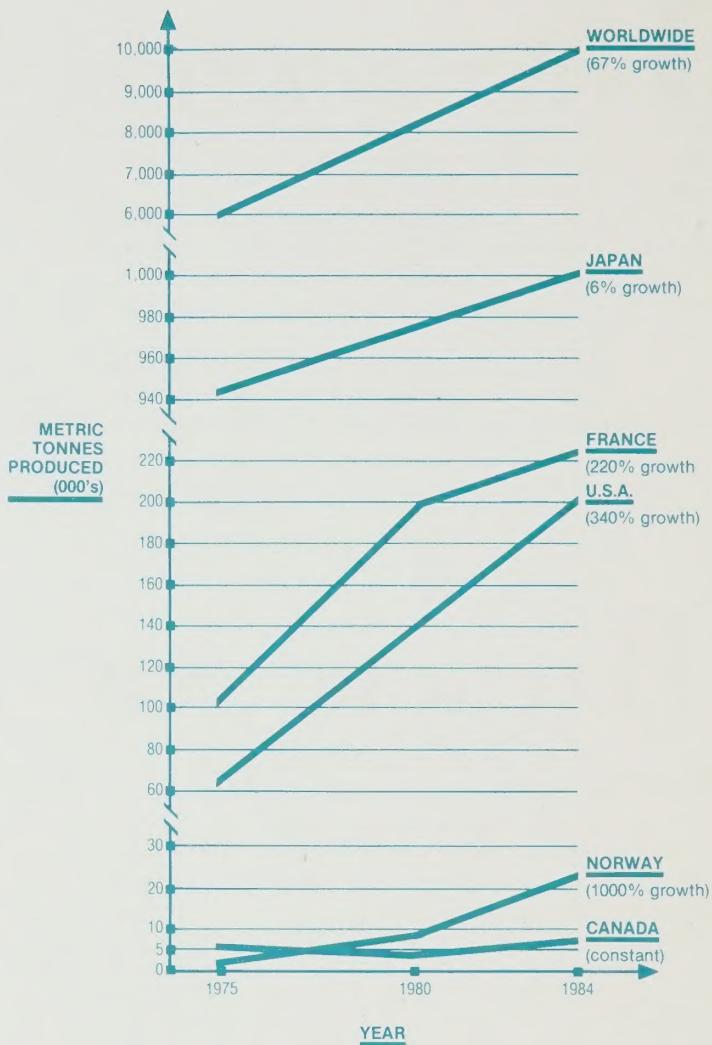


FIGURE 1  
INTERNATIONAL AQUACULTURE PRODUCTION TRENDS, 1975-1984

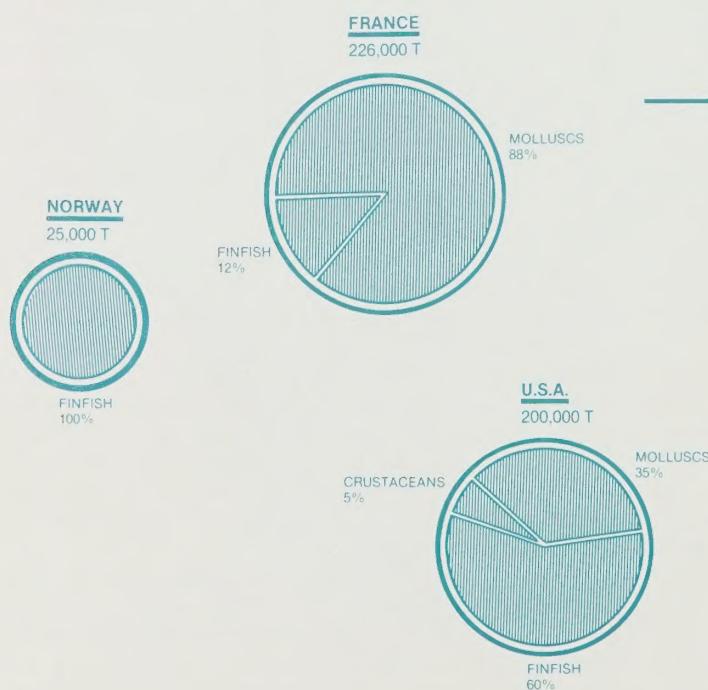


FIGURE 2  
INTERNATIONAL AQUACULTURE PRODUCTION (1984)

# THE CANADIAN INDUSTRY

The demand for fish as a source of animal protein is expected to increase rapidly over the next decade, with aquaculture continuing to provide more of the world's supply. Canada currently faces a unique opportunity to advance in the race for a share of this potentially lucrative market. The penalty for failure to do so will be the prospect of losing out to more established aquaculture countries.

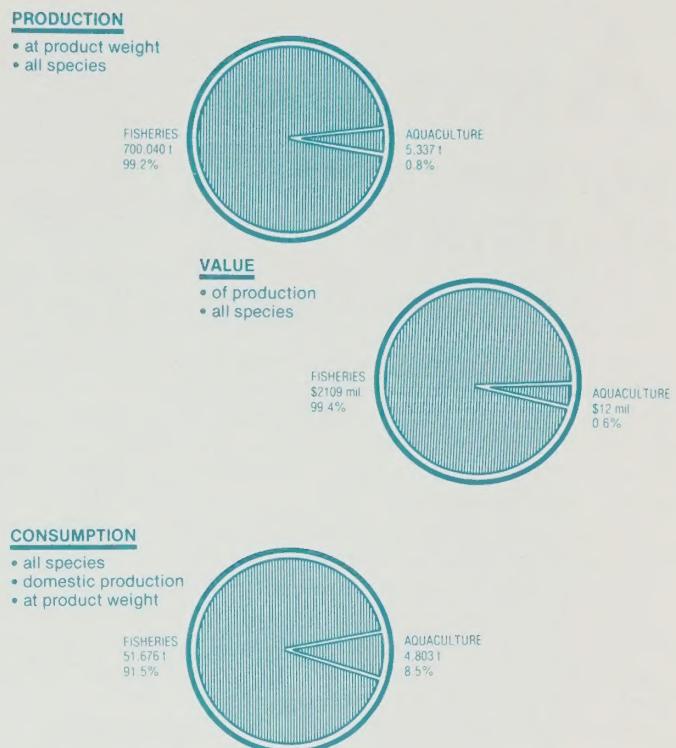
Current production levels are constrained by biological, financial, scientific and technological factors. Canadian aquaculture products are well received in domestic and international markets and there are indications of a stronger demand that is not yet being met. At present, up to 90 per cent of Canadian aquaculture output is sold domestically, while about 10 per cent is exported (mainly to the U.S.A.).

As noted above (Figure 2), aquaculture accounts for a fairly significant proportion of the volume and value of the total fisheries production of many countries. However, as Figure 3 shows, Canada still collects more than 99 per cent of its fish products from the traditional commercial fishery. This indicates that Canada's aquaculture industry is still at the take-off stage, while its wild resources are among the most productive in the world.

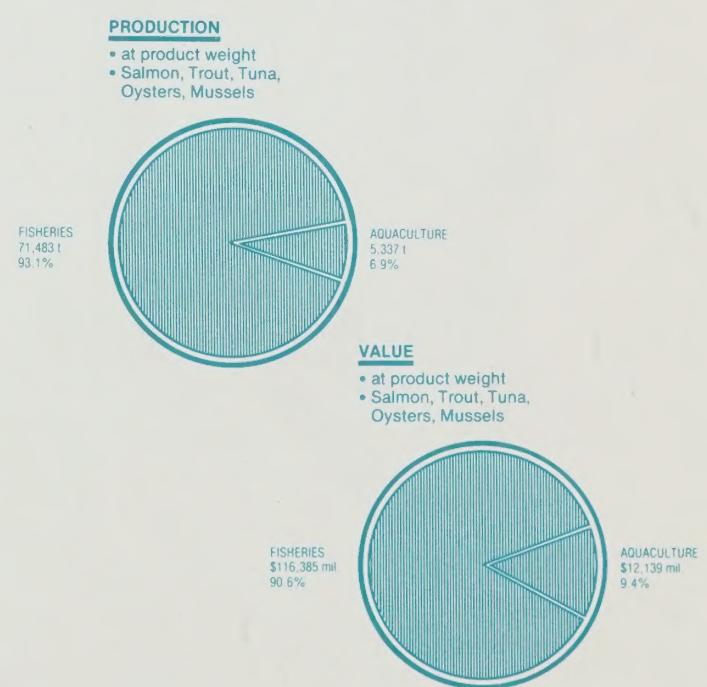
The amount of domestically produced fish Canadians eat from commercial catches compared with aquaculture sources (Figure 3), illustrates indirectly the characteristics of Canadian aquaculture mentioned above. Because 10 per cent of Canada's aquaculture food products is exported, that amount has been removed from the total aquacultural output for 1983 to determine how much aquaculturally produced fish Canadians eat.

When Canada's aquaculture and commercial catches are compared solely on the basis of equivalent species (Figure 4), it is apparent that aquaculture could become a more significant source of fish in Canada. This comparison also reflects the trend that Canadian aquaculture has taken in its development. By concentrating on species which offered higher profits, the industry was able to meet investment costs. The subsequent development of technology has been the key which has enabled aquaculture to emerge as a growth industry.

Although the national production from aquaculture has been fairly constant over the last decade, this statistical fact does not reflect what has been actually happening within the industry. Freshwater trout and oyster (much of it marginally aquaculture) have dominated the figures over the last decade but, in fact, their production has been static or declining. The variety of other species and their production levels have increased dramatically, especially in Atlantic Canada. The commercial production of Pacific salmon, Atlantic salmon and blue mussel have essentially appeared in the production statistics in the past decade and are growing rapidly.



**FIGURE 3**  
*A COMPARISON BETWEEN CANADIAN AQUACULTURE AND THE TOTAL CANADIAN FISHERIES PRODUCTION (1983)*



**FIGURE 4**  
*A COMPARISON BETWEEN AQUACULTURE AND THE TOTAL CANADIAN FISHERIES PRODUCTION ON THE BASIS OF EQUIVALENT SPECIES (1983)*

# ANNEX A

## AQUACULTURE STATISTICS

The purpose of Annex A is to provide the specific data upon which the preceding graphs were based. The statistics have been collected from the various sources listed in the bibliography.

The production and value data given are for the year 1983. Although commercial aquaculture in Canada has been undergoing a substantial transformation over the last decade, and presentation of data for one year does not capture the recent trends, this report offers a point of reference for future developments in aquaculture.

Incorporated within the data for Figures 5 through 8 are production and value amounts which are attributable to recreational pay angling. Quebec has a significant level of pay angling activity, which accounts for 75 per cent by weight and 80 per cent by value of its aquaculture production. Ontario and the prairie provinces also have a well established and substantial level of recreational pay angling activity.

Because the species caught in pay angling are consumed, the main thrust of this report is not deflected by including this activity as part of the data base. Although fish produced from wild stock enhancement projects may end up as food fish as well, the data on this segment have been excluded because it is predominantly public sector.

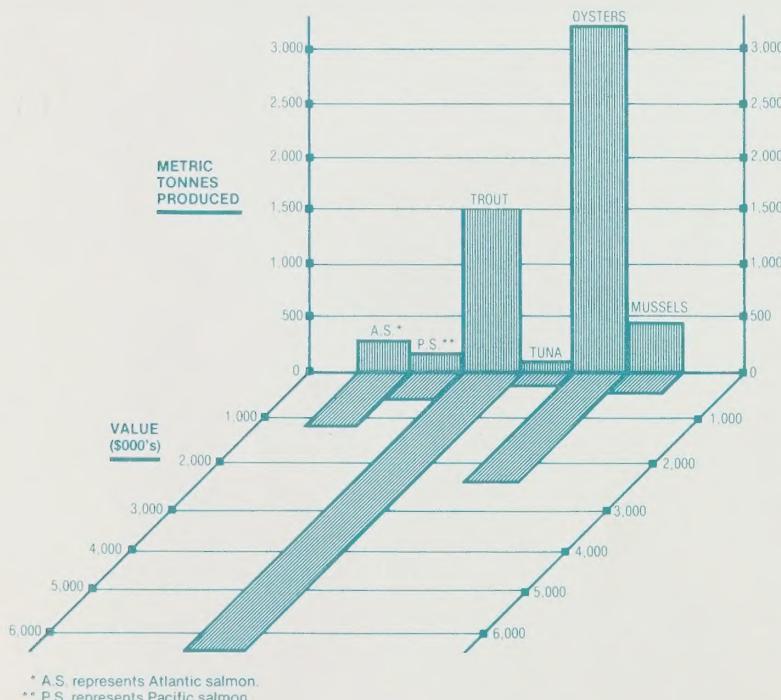


FIGURE 6  
AQUACULTURE PRODUCTION AND VALUE  
BY SPECIES (1983)

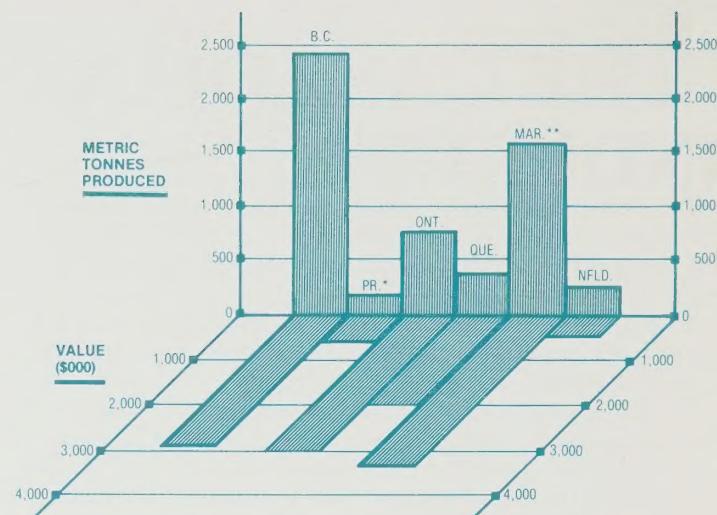


FIGURE 5  
AQUACULTURE PRODUCTION AND VALUE (1983)

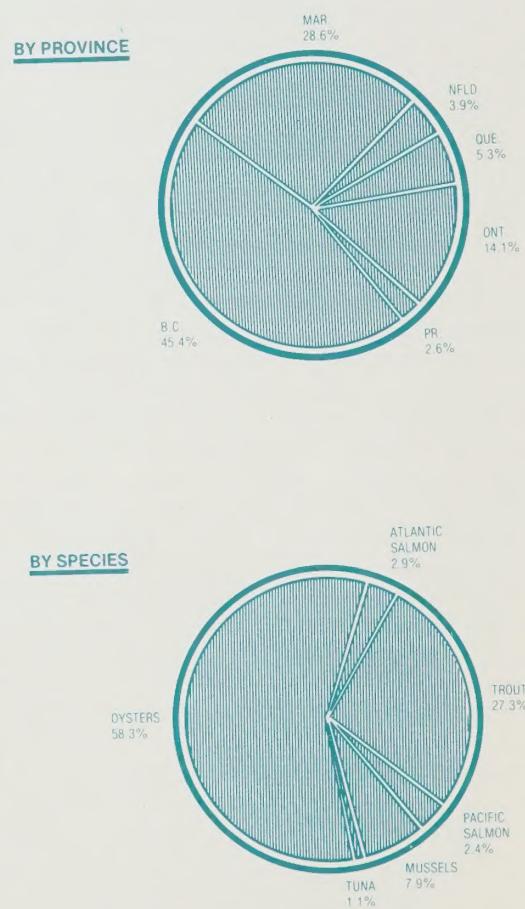


FIGURE 7  
DISTRIBUTION DE LA PRODUCTION AQUICOLE  
(TONNES MÉTRIQUES) (1983)

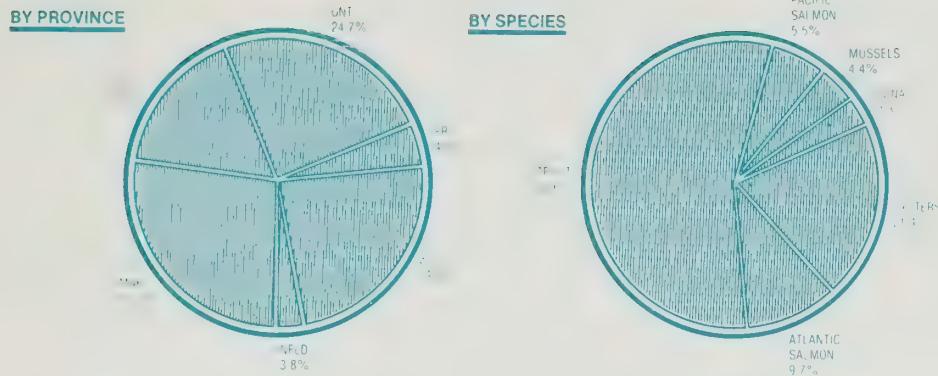


FIGURE 8  
DISTRIBUTION OF THE VALUE  
FROM AQUACULTURE  
(1983)

## INTERNATIONAL AQUACULTURE PRODUCTION (1984)

(Metric Tonnes)

	Finfish	Molluscs	Crustaceans	Seaweeds	Total
Japan	250,000	300,000	10,000	440,000	1,000,000
France	199,000	27,000	—	—	226,000
U.S.A.	120,000	70,000	10,000	—	200,000
Norway	25,000	—	—	—	25,000
Canada (Commercial only)	2,250	3,750	—	—	6,000*

\* Estimated

## INTERNATIONAL AQUACULTURE PRODUCTION TRENDS, 1975-1984

(Metric Tonnes)

	Year	1975	1980	1984
Worldwide		6,000,000	8,700,000	10,000,000
Japan		945,000	976,000	1,000,000
France		103,000	198,000	226,000
U.S.A.		60,000	135,000	200,000
Norway		2,500	7,500	25,000
Canada (Commercial only)		6,000	4,500	6,000*

\* Estimated

## Sources:

1. ARMSTRONG, G.C., *Summary Review of the Level of Research in Aquaculture and Resource Development in Canada and Other Industrialized Nations*, G.C. Armstrong Consultants Ltd., 1984.
2. CANADIAN DEPARTMENT OF FISHERIES AND OCEANS AND THE SCIENCE COUNCIL OF CANADA, *Report of the Proceedings on National Aquaculture Conference — Strategies for Aquaculture Development in Canada*, Ottawa, 1983.
3. GORDON, M.R., *The Development of Salmon Farming in Norway: A Growing Export Industry Made Up of Small Community-Based Businesses*, Fisheries Technology Division, B.C. Research, 1984.
4. INTERNATIONAL RESOURCE DEVELOPMENT INC., *Aquaculture in the 80's*, 1979.
5. PILLAY, T.V.R., *State of Aquaculture*, FAO Rome, Italy, 1981.
6. PRITCHARD, G.I., *Aquaculture — A Background Summary for the Canadian Agricultural Research Council*, Department of Fisheries and Oceans, Ottawa, 1984.

## Sources:

1. ARMSTRONG, G.C., *Summary Review of the Level of Research in Aquaculture and Resource Development in Canada and Other Industrialized Nations*, G.C. Armstrong Consultants Ltd., 1984.
2. CANADIAN DEPARTMENT OF FISHERIES AND OCEANS AND THE SCIENCE COUNCIL OF CANADA, *Report of the Proceedings on National Aquaculture Conference — Strategies for Aquaculture Development in Canada*, Ottawa, 1983.
3. GORDON, M.R., *The Development of Salmon Farming in Norway: A Growing Export Industry Made Up of Small Community-Based Businesses*, Fisheries Technology Division, B.C. Research, 1984.
4. INTERNATIONAL RESOURCE DEVELOPMENT INC., *Aquaculture in the 80's*, 1979.
5. PILLAY, T.V.R., *State of Aquaculture*, FAO Rome, Italy, 1981.
6. PRITCHARD, G.I., *Aquaculture — A Background Summary for the Canadian Agricultural Research Council*, Department of Fisheries and Oceans, Ottawa, 1984.

## A COMPARISON BETWEEN CANADIAN COMMERCIAL AQUACULTURE AND THE CANADIAN COMMERCIAL FISHERY ON THE BASIS OF EQUIVALENT SPECIES (1983)

	Fishing		Aquaculture		
	Metric Tonnes (000's)	\$ (000's)	Metric Tonnes (000's)	\$ (000's)	
Atlantic Salmon	1,174	4,939	157	1,181	
Pacific Salmon	67,137	106,985	129	670	
Trout	691	1,157	1,459	6,870	
Tuna	497	1,531	60	280	
Pacific Oyster	250	163	2,210	1,768	
Atlantic Oyster	1,490	1,375	900	830	
Mussels	244	235	422	540	
<b>Total</b>	<b>71,483</b>	<b>116,385</b>	<b>5,337</b>	<b>12,139</b>	

## AQUACULTURE PRODUCTION AND VALUE IN EASTERN CANADA (1983)

(QUANTITY (Q) IN TONNES, PRODUCT WEIGHT  
— VALUE (V) IN CANADIAN DOLLARS (000's))

	Quebec	Maritime		Newfoundland		Total		
		Q	V	Q	V	Q	V	
Atlantic Salmon	—	—	127	1051	30	130	157	1181
Pacific Salmon	—	—	—	—	—	—	—	
Trout	285	2000	170	690	30	150	485	2840
Tuna	—	—	60	280	—	—	60	280
Oysters	—	—	900	830	—	—	900	830
Mussels	—	—	272	360	150	180	422	540
<b>Total</b>	<b>285</b>	<b>2000</b>	<b>1529</b>	<b>3211</b>	<b>210</b>	<b>460</b>	<b>2024</b>	<b>5671</b>

## AQUACULTURE PRODUCTION AND VALUE IN WESTERN CANADA (1983)

(QUANTITY (Q) IN TONNES, PRODUCT WEIGHT  
— VALUE (V) IN CANADIAN DOLLARS (000's))

	British Columbia		Prairies		Ontario		Total	
	Q	V	Q	V	Q	V	Q	V
Atlantic Salmon	—	—	—	—	—	—	—	—
Pacific Salmon	129	670	—	—	—	—	129	670
Trout	84	480	140	550	750	3000	974	4030
Tuna	—	—	—	—	—	—	—	—
Oysters	2210	1768	—	—	—	—	2210	1768
Mussels	—	—	—	—	—	—	—	—
<b>Total</b>	<b>2423</b>	<b>2918</b>	<b>140</b>	<b>550</b>	<b>750</b>	<b>3000</b>	<b>3313</b>	<b>6468</b>

## AQUACULTURE PRODUCTION AND VALUE IN CANADA (1983)

(QUANTITY (Q) IN TONNES, PRODUCT WEIGHT  
— VALUE (V) IN CANADIAN DOLLARS (000's))

	WEST		EAST		CANADA	
	Q	V	Q	V	Q	V
Atlantic Salmon	—	—	157	1181	157	1181
Pacific Salmon	129	670	—	—	129	670
Trout	974	4030	485	2840	1459	6870
Tuna	—	—	60	280	60	280
Oysters	2210	1768	900	830	3110	2598
Mussels	—	—	422	540	422	540
<b>Total</b>	<b>3313</b>	<b>6468</b>	<b>2024</b>	<b>5671</b>	<b>5337</b>	<b>12139</b>

# BIBLIOGRAPHY

AIKEN, D.E., "Aquaculture in Atlantic Canada", in G.I. Pritchard [Ed.] *Proceedings of the National Aquaculture Conference — Strategies for Aquaculture Development in Canada*, Canadian Special Publication of Fisheries and Aquatic Sciences 75, pp. 6-15, 1984.

ARMSTRONG, G.C., *Summary Review of the Level of Research in Aquaculture and Resource Development in Canada and Other Industrialized Nations*, G.C. Armstrong Consultants Ltd., 1984.

BOULANGER, Y. and L.E. HANSEN, "Survey of Aquacultural Practices in Quebec", in G.I. Pritchard [Ed.] *Proceedings of the National Aquaculture Conference — Strategies for Aquaculture Development in Canada*, Canadian Special Publication of Fisheries and Aquatic Sciences 75, pp. 16-24, 1984.

BOURNE, N. and J.R. BRETT, "Aquaculture in British Columbia", in G.I. Pritchard [Ed.] *Proceedings of the National Aquaculture Conference — Strategies for Aquaculture Development in Canada*, Canadian Special Publication of Fisheries and Aquatic Sciences 75, pp. 25-41, 1984.

CANADIAN DEPARTMENT OF FISHERIES AND OCEANS, *Canadian Fisheries Highlights 1983*, Ottawa, 1984.

CANADIAN DEPARTMENT OF FISHERIES AND OCEANS AND THE SCIENCE COUNCIL OF CANADA, *Report of the Proceedings on National Aquaculture Conference — Strategies for Aquaculture Development in Canada*, Ottawa, 1983.

CARTER, P. et P. BÉLAND, "L'aquaculture marine au Québec", *Rapport technique canadien des sciences halieutiques et aquatiques*, no. 1315, Pêches et Océans, 1984.

GORDON, M.R., *The Development of Salmon Farming in Norway: A Growing Export Industry Made Up of Small Community-Based Businesses*, Fisheries Technology Division, B.C. Research, 1984.

GRAHAM, J.L., *Aquaculture in Ontario and Canada*, Department of Fisheries and Oceans, Ottawa, 1983.

INDUSTRY TASK FORCE ON AQUACULTURE, *Aquaculture: A Development Plan for Canada*, Final Report, Sponsored by the Science Council of Canada, 1984.

INTERNATIONAL RESOURCE DEVELOPMENT INC., *Aquaculture in the 80's*, 1979.

LUCAS, K.C., "Aquaculture In Canada: Getting Our Act Together", in G.I. Pritchard [Ed.] *Proceedings of the National Aquaculture Conference — Strategies for Aquaculture Development in Canada*, Canadian Special Publication of Fisheries and Aquatic Sciences 75, pp. 1-5, 1984.

MacCRIMMON, H.R., "An Overview of Aquaculture in Central Canada", in G.I. Pritchard [Ed.] *Proceedings of the National Aquaculture Conference — Strategies for Aquaculture Development in Canada*, Canadian Special Publication of Fisheries and Aquatic Sciences 75, pp. 42-55, 1984.

MacCRIMMON, H.R., J.E. STEWART and J.R. BRETT, *Aquaculture in Canada — the Practice and the Promise*, Bulletin of the Fisheries Research Board of Canada, 188: 84p., 1974.

PILLAY, T.V.R., *State of Aquaculture*, FAO Rome, Italy, 1981.

PRITCHARD, G.I., *Aquaculture — A Background Summary for the Canadian Agricultural Research Council*, Department of Fisheries and Oceans, Ottawa, 1984.

**Published by:**

Communications Directorate  
Fisheries and Oceans  
Ottawa, Ontario  
K1A 0E6

**DFO/2808/2**

Minister of Supply & Services Canada 1986  
Cat. No. Fs 23-87/1986E  
ISBN 0-662-14590-9

